Math 141H.1, Honors Calculus II

Final Exam

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No calculators. There are 12 problems.

1. Evaluate $\int_1^4 \frac{dx}{x + 2\sqrt{x}}$.

2. If $f(x) = e^x + x$ and $g = f^{-1}$, find $g'(3 + \ln 3)$.

3. Assuming exponential population growth, if the growth rate is 1 per 100 per year, how many years will it take for the population to double? Is this more than 50 years, or less?

4. Find the limit of $\sec x - \tan x$ as x approaches $\pi/2$.

5. Let R be the region $0 \leq x \leq 1$, $0 \leq y \leq e^x$. Find the volume obtained by revolving R about the y-axis.

6. Find $\int \sin^{-1} x \, dx$.

7. Evaluate the improper integral $\int_0^\infty \frac{dx}{x^2 + 4x + 3}$.

8. Use Simpson's Rule with $n = 4$ to approximate $\int_0^\pi \sin x \, dx$.

9. Find the Maclaurin series representation of $\frac{1}{(x-1)(x-2)}$.

   Hint: Use partial fractions.

10. Let $f(x)$ be a function such that $f'(x) = \sqrt{1 + x^8}$ and $f(0) = 0$. Find a power series representation of $f(x)$ centered at $x = 0$. What is the radius of convergence?

11. Find the centroid of the semicircle $y = \sqrt{1 - x^2}$, $-1 \leq x \leq 1$.

12. Find the area enclosed by the curve $r = \sin^{3/2} \theta$, $0 \leq \theta \leq \pi$.